# PUMP FOR TAIL PRODUCTION OF OIL

The invention concerns a piston pump for oil production from oil wells having low pressure.

The typical oil well in the North Sea, for example, firstly has an overpressure phase in which the oil in the structure possesses such a high pressure that it flows up through the production tubular by itself. This phase may last for some years, but gradually the pressure decreases sufficiently low for the well not to be self-producing any longer. At this stage, however, large amounts of oil remain in the structure, often as much as 80% of the total. There are mainly three methods of recovering more of the remaining amount. One method consists in gas injection down into the annulus, causing gas and liquid to flow out in a manner similar to that of a coffee maker. Another method consists in injecting water into the structure, thereby increasing the pressure therein. The third method consists in introducing a pump down in the drilling string and pumping up the oil.

Such a pump must be constructed for usage under extreme conditions. Firstly, the production tubular is of a relatively small diameter; and secondly, it pertains to lifting heights of several thousand meters, hence very high

pressures. Perhaps the biggest problem for today's pumps is that when the pressure in the oil structure is low, the amount and volume of gas in the oil will increase steadily, and the existing pumps do not function when the gas volume exceeds even a relatively small percentage amount.

Usually, these pumps are constructed with a large number of axial pumps on a long, joint shaft and have a motor either below or above the very pump that may be 10-20 meters long.

Onshore, for example well known from the USA, piston pumps are used in relatively shallow wells. The piston then is generally run up and down with a wire attached to an eccentric shaft. A pulsating oil flow, having delivery each time the piston moves upwards, is then achieved. This is acceptable when the oil column is this short.

Piston pumps are pressure-powerful in a single step and may, under certain conditions, handle a relatively large amount of gas together with liquid and should, based on this, be ideal for recovering a maximum amount of oil from deep wells having low pressures in the structure. Publications NO 305 667; US 3,625,288; US 4,268,277; US 4,536,137 and GB 2 100 362 disclose pumps based on pistons.

In deep wells, such as those in the North Sea and other offshore regions, oftentimes the length of the drill string is many kilometres, and commonly the geographic lifting height may be 3-5000 meters. Pumping under such conditions requires the oil column above the pump to flow relatively evenly; otherwise the acceleration forces will become unrealistically high.

The object of invention is a piston pump for submerging in a drilling pipe, in which the pump will produce a relatively even oil flow; tolerate relatively large amounts of gas during induction; and simultaneously having a pump with no or very small and free mass forces that produce vibration.

The pump according to the invention is shown in fig. 1 and consist of, from bottom, a suction mouth piece (1), a valve housing (2), a pump cylinder section (3), an interlock section (4), a drive cylinder section (5), a control valve housing (6) and also a hydraulic drive unit (7) on top.

As disclosed in fig. 2, the pump has four pistons, each respective end having a pump piston (101) and a drive piston (101). It is further disclosed that two of the radially opposing shafts (102) of the one piston pair is mechanically connected by means of a linkage (105), hence move axially alike. The two other piston pairs are connected with the two preceding ones at cog wheel (104) and therefore will have to move in the opposite direction of these. This provides full balancing of the mass forces in the pump at the same time the volume flow becomes relatively constant, even though a pressure surge will arise when the pistons reciprocate. On the drive side, the oil channel of the cylinders is placed below the top of the cylinder, thereby allowing the piston to stop against an oil pillow and not mechanically. In turn, the pressure surge in this oil pillow is used to rearrange a bistable 3-5 port valve that reciprocates the oil flow of the pistons. Thus, the drive unit has an even oil flow through its pump.